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FY69 • Summary Report

UTILIZATION RESEARCH AND DEVELOPMENT

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U.S. DEPARTMENT OF AGRICULTURE
Agricultural Research Service

APRIL 1970

**SUMMARY REPORT OF
UTILIZATION
RESEARCH
and
DEVELOPMENT**

FOREWORD

This report is prepared in response to a request by the Committee on Appropriations in its report to the Senate on the Agricultural and Farm Credit Administration Appropriation Bill, 1960 (Report No. 330), for an annual summary statement on utilization research and development activities conducted by the Agricultural Research Service. Previous reports have been submitted for fiscal years 1959 through 1968.

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COVER--The Department's fifth regional research laboratory, at Athens, Ga., which initiated its research program in FY 1969.

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

SUMMARY REPORT OF UTILIZATION RESEARCH AND DEVELOPMENT

Fiscal Year 1969

I AIM AND OPERATION OF UTILIZATION RESEARCH

Utilization research, aimed at expansion of agricultural markets and reduction of processing and distribution costs, can increase farm income, benefit domestic consumers, and contribute to U. S. programs of assistance to developing countries. Such research can help to bring into balance the supply of, and demand for, farm commodities. In pursuing its objectives, USDA's utilization research and development effort is directed to: (a) devising new food products that are attractive and economical, and fit the distribution requirements in worldwide market channels; (b) improving functional properties of the natural fibers, cotton, wool, and mohair, to better meet consumer needs; (c) developing more economic and more suitable processed feed products needed in the expansion of the poultry, dairy, and livestock industries; and (d) seeking broadened and profitable industrial uses for agricultural materials. Concurrent attention is given to such related functions as expansion of foreign markets for U.S. agricultural products, improved nutritional quality of food products, protection of food products from contamination by toxins and other health hazards, and reduction of pollution caused by agricultural processing wastes.

The Department's utilization research investigations in fiscal year 1969 were conducted primarily in Federal facilities in the United States, consisting of five divisions, or Regional Research Laboratories (located in New Orleans, La.; Albany, Calif.; Wyndmoor, Pa.; Peoria, Ill.; and Athens, Ga.) and twelve subsidiary field locations (in Beltsville, Md.; Washington, D. C.; Waltham, Mass.; Lexington, Ky.; East Grand Forks, Minn.; Olustee and Winter Haven, Fla.; Raleigh, N.C.; Weslaco, Tex.; Pasadena, Calif.; Honolulu, Hawaii; and Puyallup, Wash.). Additional research outside of these laboratories and field locations is conducted through contracts, grants, and memoranda of understanding with State Experiment Stations, universities, private research institutions, and industry. Other supporting research is conducted in foreign research institutions through funds generated by the P.L. 480 program (Agricultural Trade Development and Assistance Act of 1954, 83rd Congress, 2nd Session, as amended). The Regional Research Laboratories, with the subsidiary field locations, constitute five of the nine divisions of the Marketing and Nutrition Research group of the Agricultural Research Service.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE

Continuing, positive emphasis is placed on disseminating the results of utilization research to interested segments of the agricultural industry. The following summary illustrates the uses made of various information media in F.Y. 1969:

- 104 patents granted
- 915 technical papers published
- 705 speeches, press releases, and appearances on radio and television
- 36 formal conferences with industrial and other organizations
- 40 exhibits for the public and technical groups
- 7,450 technical visitors to UR&D installations

(A) Exhibit Materials

Numerous special exhibits were prepared and shown during F.Y. 1969 to inform the public and technical groups of USDA developments in food, fiber, and industrial products made from agricultural sources. Examples of the exhibits are:

Nature of Exhibit	:	Group Concerned
Cottonseed protein concentrates and isolates	:	Cottonseed Processing Clinic, New Orleans, La.
Lace garments and other goods	:	Cotton Utilization Research Conference, New Orleans, La.
Instrument for measuring projected mean length and fiber hooks of cotton	:	First International Symposium on Cotton Textile Research, Paris, France
Flame retardant cotton fabrics	:	First International Symposium on Cotton Textile Research, Paris, France
Research on new agricultural products	:	California State Fair, Sacramento, Calif., & National Science Teachers' Association Symposium, Pleasant Hill, Calif.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(A) Exhibit Materials (contd.)

Nature of Exhibit	:	Group Concerned
WURLANized wool	:	Oregon Museum of Science and Industry, Portland, Ore.
Dehydrated foods	:	Oregon Museum of Science and Industry, Portland, Ore.
WURLANized wool	:	Ukiah-Boonsville District Lamb Show, Ukiah, Calif.
	:	National Wool Growers Association, San Francisco, Calif.
Pharmacology research	:	Western Utilization Research and Development Division, Albany, Calif.
Rapid freezing of food products	:	Western Utilization Research and Development Division, Albany, Calif.
Utilization of alfalfa	:	Eastern Utilization Research and Development Division, Wyndmoor, Pa.
Woolen knitting stitches	:	National Association of Industrial Artists, Fifth National Competition, Department of Commerce, Washington, D. C.
	:	National Wool Growers Association, San Francisco, Calif.
Meat processing research	:	Eastern Utilization Research and Development Division, Wyndmoor, Pa.
Research on leather defects (including cockle) and on shearlings and other leathers	:	Eastern Utilization Research and Development Division, Wyndmoor, Pa.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(A) Exhibit Materials (contd.)

Nature of Exhibit	:	Group Concerned
	:	
Explosion puffing of food products (film of commercial operation of process)	:	Eastern Utilization Research and Development Division, Wyndmoor, Pa.
	:	
Potato flakes, explosion-puffed potatoes, and recovery of valuable substances from potato waste water	:	Eastern Potato Industry Exposition, Harrisburg, Pa.
	:	
Products from starch of selectively-bred high-amylose and waxy corn	:	Meeting of Illinois Society of Professional Farm Managers and Rural Appraisers, Peoria, Ill.
	:	
Product potential for crambe and other new oilseed crops	:	Meeting of Illinois Society of Professional Farm Managers and Rural Appraisers, Peoria, Ill.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations

Conference	Sponsors	Attendance	Location
1968 Conference on Citrus Chemistry and Utilization (10/11/68)	USDA	98	Winter Haven, Fla.
Flame Retardant Cotton Batting Workshop (11/15/68)	USDA, Foundation for Cotton Research & Education of NCCA, and trade associations	217	New Orleans, La.
18th Cottonseed Processing Clinic (2/3-4/69)	USDA and a trade association	99	New Orleans, La.
15th Annual Joint Conference of Cooperative Oil Mills (3/16-18/69)	USDA	219	Washington, D. C.
9th Cotton Utilization Research Conference (4/30-5/2/69)	USDA	223	New Orleans, La.
Conference on Naval Stores Products, Adhesives, Tackifiers, and Related Products (5/15/69)	USDA and Batelle Memorial Institute	80	New Orleans, La.
Western Experiment Station Collaborators Conference (3/12-14/69)	USDA and University of California	99	Albany, Calif.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

Conference	Sponsors	Attend- ance	Location
Conference on Reverse Osmosis in Food Processing (1/23/69)	USDA and National Canners Association	150	Albany, Calif.
Lemon Products Technical Committee (4 times during year)	USDA and lemon industry	59	Pasadena, Calif.
Annual Citrus Research Conference (12/3/68)	USDA and citrus industry	60	Pasadena, Calif.
Fruit & Vegetable Processing Conference (8/28-30/68)	USDA and fruit and vegetable industries	20	Puyallup, Wash.
18th National Potato Utilization Conference (7/30-8/2/68)	USDA, United Fresh Fruit & Vegetable Assn., Oregon State Univ., and Oregon Potato Commission	197	Corvallis, Ore.
9th Dry Bean Research Conference (8/13-15/68)	USDA, National Dry Bean Council, and Colorado State Univ.	108	Fort Collins, Colo.
2nd National Apple Utilization Conference (5/19-21/69)	USDA and Washington State Univ.	110	Yakima, Wash.
10th Technical Alfalfa Conference (7/11/68)	USDA, American Dehydrators Assn., and Univ. of Nevada	200	Reno, Nev.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

Conference	Sponsors	Attend- ance	Location
Wine Institute Technical Advisory Committee (3 times during year)	USDA and Wine Institute Technical Committee	200 200 400	California San Francisco Fresno San Francisco
7th Triennial Maple Industry Conference (10/8-9/68)	USDA and maple syrup processors	140	Wyndmoor, Pa.
Eastern Experiment Station Collaborators Conference (10/29-30/68)	USDA	50	Wyndmoor, Pa.
Evaporated Milk Association Conference (10/22-23/68)	USDA and Evaporated Milk Assn.	40	Wyndmoor, Pa.
Tanners Conference (12/10-11/68)	USDA and American Leather Chemists' Association	23	Wyndmoor, Pa.
Northeast Agricultural Experiment Station Directors (3/13-14/69)	USDA	47	Wyndmoor, Pa.
Meat Packers and Processors Seminar (3/11-12/69)	USDA, Meat Packers Assn., Penna. State Univ., Rutgers Univ., and Univ. of Maryland	74	Hershey, Pa.
American Bakers Assn. Technical Liaison Committee (9/19-20/68)	USDA and American Bakers Association	50	Peoria, Ill.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

Conference	Sponsors	Attend- ance	Location
Annual Corn and Wheat Utilization Conference, Technical Committee (10/15-16/68)	USDA, Corn Industries Research Foundation, Technical Committee of Corn Refiners Assn.	71	Peoria, Ill.
North Central Agric. Expt. Sta. Collaborators Symposium (3/17-18/69)	USDA and North Central Agr. Exp. Sta. collaborators	68	Peoria, Ill.
15th Annual Joint Conf. of Coop. Soybean & Cottonseed Oil Mills (3/17-18/69)	USDA	220	Washington, D. C.
Soybean Utilization Research Conf. (3/27/69)	USDA and National Soybean Producers' Assn.	51	Peoria, Ill.
Fatty Acid Producers Council & Technical Committee Meeting (5/13/69)	USDA	39	Peoria, Ill.
Annual Corn Dry Milling Conf., Research Liaison Committee of Amer. Corn Millers Federation (6/24/69)	USDA and Amer. Corn Millers' Federation	52	Peoria, Ill.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities

During F.Y. 1969 substantial technical, economic, and management assistance was given to the establishment of agricultural processing enterprises in rural communities. This assistance was given to existing organizations, newly-formed community groups, state and regional technical action panels, and other groups concerned with rural community development. It embraced a broad range of subject categories and involved groups ranging from the smallest to multi-million-dollar enterprises, as illustrated by the following selected examples:

Cooperative program planning with five regional economic development commissions (Upper Great Lakes, New England, Four Corners, Ozarks, Coastal Plains), the Office of Economic Opportunity, and the Small Business Administration

New agricultural processing and handling methods to reduce pollution (Ohio, Utah, Idaho, Washington, Tennessee, and Louisiana)

Assistance in utilizing "hard core" unemployed in agricultural processing industries (Milwaukee, Wis.)

New fruit and vegetable products and processes (Gilroy and Yucipa, Calif.; Grand View, Wash.; Wise County Va. (EDA project); West Texas High Plains; Floridana, La. (EDA project); Sunny Roza, Wash. (EDA project); Rhode Island (EDA project); New Mexico (EDA project); northeastern Mississippi (EDA project)

New citrus-blend concentrates (Auburndale, Fla.)

New sweetpotato products and processes (Lafayette, La.)

Processes for new and improved varieties of peaches and nectarines (several eastern states)

New tomato products and processes (Donna, Tex.; Martinez, Calif.)

Processes for mechanically harvesting cherries and apples (Michigan, New York, and Pennsylvania)

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

Manufacture of improved mushroom products (Missouri and Pennsylvania)

Cereal grain products and processes; (Roby and Elkhart, Ind.; Wyandotte, Mich.; Winston Salem, N.C.; Port Angeles, Longview, and Port Townsend, Wash.)

Production, processing, and marketing of waxy corn and high-amylose corn (Boone, Iowa; Le Sueur, Minn.; Granite City and Quincy, Ill.)

New and improved mixed feed products (Frazee, Minn. (EDA project); Ozarks Economic Development Region (Ozarks Commission project))

New feed products from alfalfa through wet processing (Brawley, Calif.)

Production of consumer items from flame resistant cotton fabrics, improved wash-wear cotton, and improved cotton batting products (New Roads, La.; Thomaston, Ga.; St. Peter, Minn.; Griswoldville, Mass.)

Improved tanning process (glutaraldehyde) for woolskin and other hides (Quakertown and Bristol, Pa.)

High protein cottonseed flour processing and products (Osceola, Ark.)

New products from peanuts (peanut flour, partially defatted peanuts, meal products) (Falls Church, Va.; Texas and Oklahoma (EDA project))

New processes for crambe (a new oilseed crops) (Iowa City, Iowa; Alexandria, La.)

Improved processing of pistachio nuts (southern California)

New oilseed products and processes (Denison, Tex.; Van Nuys, Calif.; Peoria, Ill.; Mt. Vernon, Ohio)

New products and processes for sunflower seed (Gonvick, Minn.)

Catfish farming, processing, and marketing (Sinton, Tex.; Lonoke and Diller, Ark.)

New and improved naval stores products and processes (Alexandria, La.; southeastern states (EDA project); Four Corners Economic Development Region (Four Corners Commission project))

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

New process for maple sirup and related products (New York, Pennsylvania, and other maple producing states)

New polysaccharide gums for use in dairy food production (Waukesha, Wis.)

Kill-and-chill and other primary animal processing (Louisiana (EDA project))

New ready-to-eat meat products including barbecue meats, fabricated lamb items, frozen meat dishes, and smoked meat products (Pennsylvania)

New dairy processes and products including foam spray drying of milk and whey, manufacture of butteroil, production of low fat cheese, new milk pasteurization techniques, and utilization of whey and other dairy wastes (virtually nationwide; Four Corners Development Region (Four Corners Commission project))

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS

Cooperative work with other groups is undertaken to develop new products, to improve existing products and processes, to devise economic processes for product manufacture, to evaluate products and processes, and to explore new outlets for agricultural products. These cooperative efforts contribute to early commercialization and broadened usage. Examples of cooperative research and development conducted in F.Y. 1969 are as follows:

Activity	Cooperators with USDA
Imparting flame and rot resistance to cotton	Army Natick Laboratories
Semidurable flame retardants for cotton	Cotton Producers Institute
Development of efficient, low-cost flame retardant treatments for cotton batting	National Cotton Batting Inst., Textile Fibers & Byproducts Assn., Foundation for Cotton Research & Education, National Cottonseed Products Assn., National Assn. of Bedding Manufacturers
Improved outdoor cotton fabrics	Canvas Products Assn. International, Cotton Producers Institute
Optimal cotton fabric structures for men's and boys' trousers, dress suits, and durable press apparel	Cotton Producers Institute
Improved insect-resistant cotton bags for storage and shipment of cereal foods	Textile Bag Manufacturers Assn.
Investigation of cottonseed protein systems as basis for developing high-protein food products	Foundation for Cotton Research & Education, National Cottonseed Products Assn.
Orange and grapefruit crystals for instant juice with consumer appeal	Florida Citrus Commission

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

Activity	:	Cooperators with USDA
Fermentative processing of cucumbers and other vegetables	:	North Carolina and Michigan Agric. Expt. Stations, Pickle Packers International, Inc.
Commercial development of dry-peeling of potatoes from pilot plant to production scale	:	Idaho Potato Processors Assn., Engineering Commission
Modification of dry-peeling methods for sweet potato peeling	:	Bush Bros. Cannery, Ville Platte, La.
Olive brine purification	:	National Canners' Association
Sorting and handling of mechanically harvested dates	:	California Date Growers Assn.
Study of microbiology of dried fruits and nuts and methods for eliminating bacterial contamination	:	Dried Fruit Association
Study to correlate cultural practices and Concord grape juice quality	:	Irrigation Agricultural Research & Extension Center, Washington State University
Plant-scale tests on recently-developed improved WURLAN wool process	:	Columbia Knitting Mill
Study on improvement of broiler quality	:	University of California and Foster Farms
Plant-scale tests on spray-drying egg white partially concentrated by reverse osmosis	:	Henningsen Company, Springfield, Ill.

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

Activity	:	Cooperators with USDA
Wet processing of alfalfa	:	Batley-Janss Enterprises, Brawley, Calif.
Production of WURLD wheat for testing in Far Eastern markets	:	Dow Chemical Co., Church World Service, Guam Economic Authority
Biological assay of carcinogenic activities of tobacco, smoke condensate, and related products	:	University of Kentucky
Development and evaluation of cigarette modifiers which alter smoke composition	:	University of Kentucky, American Tobacco Co.
Biological evaluation of cigarette smoke constituents	:	Roswell Park Memorial Institute
Neutral constituents in cigar smoke from different types of cigars	:	Cigar Manufacturers Assn. of America
Influence of combustion modifiers on the vapor phase constituents of cigarette smoke	:	Houdry Laboratories, Air Products and Chemicals, Inc.
Improved cider and cider products	:	Steroline Systems Corp.
Dehydrated vegetables for rapid rehydration	:	Gilroy Foods, Inc.
Dehydrated fruits for rapid rehydration	:	Musselman Division, Pet, Inc.
Preparation of dehydrated pumpkin and squash powder	:	Central Michigan Foods, Brown Frosted Foods
Preparation of dehydrated mush- room powder	:	Hogan Associates, Kennett Canning Company

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

Activity	Cooperators with USDA
Chemical "looseners" for sweet cherries and apples	Michigan State University
Weights and measures for cherries for processing	Michigan Department of Agriculture
Heat transfer characteristics of dried milk	University of Michigan
Storage stability of fluid milk during iodine-131 decay	Pet, Inc.
Development of new foods containing cheese whey	UNICEF
Preparation and testing of grease from animal fat derivatives	Aero Materials Dept., Naval Air Development Center
Additive chlorination and hydrogenation of animal fats	Ashland Chemical Co.
Laundrying and disinfection of shearlings	Southern Research Institute
Processing of cockle sheepskins	Morris Fishman & Sons, Inc., A. C. Lawrence Leather Co.
Analysis of corn samples to guide geneticists in developing high-amylose corn for industrial use	Bear Hybrid Corn Co.
Utilization of linseed oil in protective coatings	National Flaxseed Processors Assn., North Dakota State Univ.
Development of superior plant sources of vegetable oils of high erucic acid content	Oregon Agricultural Expt. Sta.

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

Activity	:	Cooperators with USDA
Utilization of wheat in commercial pulp and paper industries	:	Washington State University .
Feeding studies on utilization of xanthan gum in food products	:	Kelco, Inc.
Commercial processing of crambe seed	:	Independent Mill and Gin, Inc., Alexandria, La.
Utilization of agricultural products in southern pine plywood adhesives	:	U.S. Plywood - Champion Papers, Inc.
Utilization of new oilseed crops	:	Southern Indiana Agricultural Improvement Assn.
Utilization of cereal flours in the pulp and paper industry	:	Quaker Oats Company, Chicago, Ill.

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS

(A) Planning and Advisory Activities

The USDA program of utilization research on farm commodities is the product of extensive planning that is continually updated. Its administration is the direct responsibility of a deputy administrator of the Agricultural Research Service, his supporting staff, and the directors of the five Regional Research Laboratories. A Program Planning and Evaluation Staff of ARS, composed of economic specialists, assists this administrative group in evaluating the appropriateness and commercial feasibility of proposed and existing utilization research projects. Information and guidance are sought from various other sources both within and without the Department. Among the advisory groups that oversee the program, the following may be mentioned:

National Program of Research for Agriculture. Pursuant to a directive from the Senate Committee on Appropriations (Senate Report No. 156), in 1965-1966 a joint study was made by representatives of USDA, State Agricultural Experiment Stations, and the land-grant colleges, to look into all areas of agricultural research conducted by the Department and the State Experiment Stations. A report of the study, entitled "A National Program of Research for Agriculture" and essentially completed in F.Y. 1966, includes an appraisal of the current status of agricultural research and definition of future agricultural needs.

To implement the recommendations of the National Program, the establishment of 32 task forces was recommended. The following are concerned with utilization research: Cotton; soybeans; peanuts; corn and grain sorghum; wheat and other small grains; rice; fruits; vegetables; sugar crops; tobacco; minor oilseeds as well as miscellaneous and new crops; forestry; forage, range, and pasture; beef; dairy; swine; poultry; sheep and other animals; food and nutrition; food safety; pollution in relation to agriculture; and foreign aid and market development.

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(A) Planning and Advisory Activities (contd.)

Agricultural Research Policy Advisory Committee. This committee, established in 1969, has for co-chairmen USDA's Director of Science and Education and the president of a land-grant college or university. USDA representatives include the administrators of the Agricultural Research Service, Cooperative State Research Service, Economic Research Service, Farmer Cooperative Service, Federal Extension Service, and Statistical Reporting Service, and the deputy chief for research of the Forest Service. State representatives include an Agricultural Experiment Station director from each of four agricultural regions, and representatives of the National Association of State Universities and Land-Grant Colleges, the Association of State College and University Forestry Research Organization, and the Experiment Station Committee on Organization and Policy.

The objectives of this committee are to assist in solving local, regional, and national problems affecting agriculture, forestry, other renewable natural resources, and rural life; in providing scientific expertise to local, state, and Federal government agencies, private organizations, and individuals; in providing scientific competence for teaching and to make available increased research opportunities for graduate students, in providing a continuing flow of new knowledge essential to the solution of current and future problems; and in providing scientific expertise and research in support of programs that relate to foreign nations.

National Agricultural Research Advisory Committee. An 11-member advisory committee, with broad national interests in all phases of agriculture, evaluates the Department's entire research program and offers suggestions, particularly on policy matters, for changes in the program. Six of the committee members are representatives of producers or producer organizations.

National Advisory Committee on Rural Areas Development. An advisory committee representing agricultural industries, farmers, educational institutions, finance groups, and regional representatives, that makes recommendations for the greater development of rural areas.

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(A) Planning and Advisory Activities (contd.)

Agricultural Associations and Industry Groups. Advice is sought from, and information is exchanged with, all segments of the agricultural industry, including growers, shippers, processors, and distributors, concerning the many problems involved in the profitable development of new or improved uses for agricultural commodities.

Consumer Interests. Information on consumer desires for new or improved products, and on evaluation of such products, is sought through contacts with consumer groups of national and regional scope. Other USDA groups--the Economic Research Service, the Federal Extension Service, and the ARS marketing and consumer use research groups--provide advice on consumer needs and market trends.

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection

The utilization research program is continually reviewed to assess its fruitfulness. Investigations that have reached their objectives are discontinued. Investigations that have passed the point of maximum returns, or are otherwise relatively unproductive, also are discontinued so that the resources may be more effectively applied to new programs. More promising investigations are established or intensified, either by reduction of effort on projects of lesser importance or by use of such new resources as may become available. Examples of the redirection of research effort are shown below:

Old Lines of Research Terminated or Redirected	:	New or Expanded Lines of Research to Replace Previous Activity
<u>Cereal and Forage Crops</u>		
Rice kernel composition in relation: to improved products for various end uses	: : :	Conditioning rice kernels to increase milling yields
Chemical and physical treatments to increase the feed value of stem material in alfalfa feeds	: : : :	Development of industrial products from waste rice hulls
Studies on location and nature of lipids in hybrid corn kernels	: : : :	Location in the corn kernel of lytic and oxidative enzymes important to flavor and storage stability
Selected aspects of studies on genetic factors influencing mating and sporulation of yeasts	: : : : : :	Effects of artificial drying and storage in lipids of whole grain corn and milled fractions Microbial production of the anti- leukemic enzyme L-asparaginase

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

Old Lines of Research Terminated or Redirected	New or Expanded Lines of Research to Replace Previous Activity
<u>Cotton, Wool, and Other Fibers</u>	
Reactions for reversible crosslinks for cotton apparel uses	Reactions adaptable to delayed cure crosslinking requiring no external catalyst
Spatial and structural effect of crosslinks in cotton	Thermal investigation of reversible crosslinks in cotton cellulose
Equipment for feeding cotton to textile carding machines	Equipment for efficiently carding low-quality cottons
Incorporation of polyfluorinated compounds into cotton fabrics	Treatment of cotton with fluorine compounds for better antisoiling properties
Compounds to impart flame, wrinkle, stain, and abrasion resistance to cotton	Durable and semidurable flame retardants for cotton
Fixation of resilient polymer films on cottons to improve textile properties	Attachment of textile finishing agents to cotton as crosslinked polymer films
Influence of restraint on capacity of cotton fibers to sorb swelling solutions	Caustic sorptivities of cottons after smooth-drying treatments
Microscopic evaluation of vapor phase treated cotton	Morphology of cotton crosslinked or graft polymerized by vapor treatments
Flame retardant cotton with improved abrasion resistance	Flame retardants for cotton based on phosphonium compounds
All-cotton fabrics for abrasion resistant durable-press garments	Improved cotton durable-press by use of bulking and crosslinking agents

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

Old Lines of Research	:	New or Expanded Lines of Research
Terminated or Redirected	:	to Replace Previous Activity
	:	

Cotton, Wool, and Other Fibers (contd.)

Cellulose reorganization for	:	Improved premercerization techniques
preparing durable-press cotton	:	for durable-press cotton fabrics
fabrics	:	
	:	
Free radical reaction mechanisms	:	Free radical reactions of cotton
of cotton cellulose	:	to make durable-press products
	:	
Production of a continuous and	:	Cotton fiber behavior in electro-
uniform supply of individualized	:	static fields
cotton fibers	:	

Fruits and Vegetables

Seasonal variations in color and	:	Improved processed products from
flavor of Texas colored grape-	:	Texas citrus grown under varying
fruit	:	conditions
	:	
Effect of peel flavone on flavor	:	Bitter components of Florida
of orange juice	:	citrus fruits as related to
	:	processing factors
	:	
Improvement of commercial utility	:	Flavor concentrates to improve
of foam-mat process for citrus	:	foam-mat dried and other citrus
crystals	:	products
	:	
Enzyme reactions to increase	:	Control of enzyme reactions to
natural flavor of citrus products	:	improve quality of citrus products
	:	
New and improved sweetpotato	:	New sweetpotato products through
products	:	flavor enhancement and process
	:	improvements
	:	
Development of improved methods	:	Evaluation and improvement of
for processing mechanically	:	public health aspects of fruit
harvested dates	:	and tree nut products

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

Old Lines of Research	:	New or Expanded Lines of Research
Terminated or Redirected	:	to Replace Previous Activity

Fruits and Vegetables (contd.)

Identification of individual constituents affecting clarity of apple juice	:	Investigation of processes for freeze-drying and freeze concentrating fruit juices
Preservation of apple cider	:	Improved procedure for peeling apples
Explosion-puffed dehydrated fruit	:	Recovery of proteins from potato starch factory wastes

Oilseeds

Preparation of esters from cottonseed oil fatty acids	:	Sugar and other polyol esters of cottonseed fatty acids by lower cost processes
Inactivation of aflatoxin in peanut products by basic nitrogen compounds	:	Practical commercial-scale processes for inactivation of aflatoxins in peanut meal
N-substituted fatty amides from cottonseed oil	:	Evaluation of fatty amides from cottonseed oil as lubricants and for other uses
Phase relation and solubility data for cottonseed oil derivatives	:	Structure and properties of cottonseed fatty acid derivatives from spectral data
New and improved low-fat peanut products	:	New low-fat peanut products and practical processes for their production
Synthesis of amines and related derivatives of fatty acids of castor oil and their evaluation for industrial uses	:	New urethane polymers from castor oil for elastomers, sealants, and cellular and solid plastics

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

Old Lines of Research	:	New or Expanded Lines of Research
Terminated or Redirected	:	to Replace Previous Activity
	:	

Oilseeds (contd.)

Microbial modification of fatty acids	:	Bacterial production of α -galactosidase for processing soybean food products
	:	
Heat gelation of soybean protein	:	Identification and removal and flavor components of isolated soybean protein
	:	

New and Special Plants

Useful new materials from pine gum photoperoxides	:	Polybasic acids from rosin useful in preparing condensation polymers
	:	
Methods for purifying sweet sorghum juices for sugar recovery	:	Pilot-plant processing of sweet sorghum juices for sugar recovery

Poultry, Dairy, and Other Animal Products

Mechanism of antioxidants in preventing rancidification in poultry products	:	Determination of the upper limits for practical pasteurization of all types of egg products
	:	
Development of foam-spray dried whole milk powder (decreased effort)	:	Preparation and properties of reconstructed milks and new whey products
	:	
Stability of sterilized concentrated milk (decreased effort)	:	Preparation of iron fortified milk
	:	
Development of vacuum foam-dried whole milk powder (decreased effort)	:	Development of process for manufacture of enol esters of fatty acids
	:	
	:	Recovery of proteins from potato starch factory wastes
	:	
	:	Developing method for preparing an edible dispersion of cattlehide
	:	
	:	Engineering study of "wet-end" leather manufacturing operation

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

Old Lines of Research	:	New or Expanded Lines of Research
Terminated or Redirected	:	to Replace Previous Activity
	:	

Poultry, Dairy, and Other Animal Products (contd.)

Development of mushroom powder	:	Developing method for preparing
	:	an edible dispersion of cattle-
	:	hide
	:	
	:	Engineering study of "wet-end"
	:	leather manufacturing operation

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(C) Status of Domestic Research Projects

Summary Statement

	: Active at : beginning : FY 1969	: Initiated : or : revised	: Terminated : : at end : FY 1969
Domestic	451	125	129*
Foreign (P.L. 480)	126	11	45
Total	577	136	174

Commodity Classification of New Domestic Work
Undertaken in FY 1969

	: Domestic	: Foreign	: Total
Cereal and forage crops	16	2	18
Cotton, wool, and other fibers	32	1	33
Fruits and vegetables	22	2	24
Oilseeds	20	2	22
New and special plants	19	1	20
Poultry, dairy, and other animal products	16	3	19
Total	125	11	136

* 125 projects were terminated because the objectives had been wholly or substantially achieved; the remaining 4 projects were terminated because the results were unpromising, or because the work was superseded by research of higher priority.

** Includes 128 domestic contract and grant projects, 2 projects wholly or partly supported by industry (fellowships and direct financial support), and 1 project supported by funds transferred from another Federal agency.

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(D) New or Expanded Research Initiated with New Appropriations in
FY 1969Cereals and Forage Crops

Development of new economical wheat and rice products for export and domestic markets (expansion of existing in-house program)

Studies of the nutritional factors for ruminants contained in the water-soluble fractions of alfalfa

Conditioning rice kernels to increase milling yields (expansion of existing in-house program)

Transformations of nutritionally essential amino acids in cereal proteins designed to provide new and improved methods for their determination

Cotton, Wool, and Other Fibers

Principles for obtaining resilience in cotton through uses of polymers

Imparting magnetic properties to cotton fibers

Controlled polymeric deposition and crosslinking to produce improved cotton textiles (expansion of existing in-house program)

Electron microscopic study of the surface structure of wool and mohair

Fruits and Vegetables

Development of processing techniques for improved dry bean products

Compositional investigation of citrus fruits to permit improvement in flavor and color of products

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(D) New or Expanded Research Initiated with New Appropriations in
FY 1969 (contd.)Oilseeds

Development of processes for new safflower meal products with high nutritional value (expansion of existing in-house program)

Improved monomers for nylon polymers from high-erucic acid oils

Allylic monomers and polymers from high-erucic acid oils

Internally plasticized films using comonomers derived from high-erucic acid oils

Expand research on flavor, flatus, and color of soybean protein food products

Expand research on methods for production of improved, edible, full-fat soybean flours suitable for development of specific new, high-protein soy foods

Research on pilot plant preparation and evaluation of nylon-9

Poultry, Dairy and Other Animal Products

Development of new foods containing cheese whey

Study of biodegradation of detergents to develop new and expanded outlets for animal fats

Development of new or improved processes and products for the sausage industry

V CURRENT UTILIZATION RESEARCH PROGRAM

USDA's utilization research program is directed to finding new or improved uses and improved processing methods for agricultural commodities through basic, applied, and development research. As previously indicated, it is subject to continual review and appraisal at all levels, from Work Units (limited assignments involving up to several man-years of effort for periods of not more than five years) up through broad general areas of activity. As examples of program changes in the latter category, it may be mentioned that increasing attention is being given to food safety, with major emphasis on elimination of salmonella bacteria from foods and feeds, and on control of toxins from fungi in foods and feeds; to development of products specifically suited to cash export markets; and to development of modifications in the processing of agricultural commodities that will minimize air and water pollution problems.

The following listing of subject fields will illustrate the general nature of the current program:

Cereal and Forage Crops

Emphasis on development of new uses for corn and wheat, with concurrent effort on rice, barley, oats, sorghum, and alfalfa and other legume and grass forages:

Increasing milled rice yields by practical new procedures.

New and improved food products--Improved flavor of bread made from abbreviated fermentation doughs; improved physical properties of wheat doughs; improved quality of frozen unbaked bread; new and improved rice products with better nutritive value and other quality factors; new products from rice hulls; improved maturation of wheat flours; new and improved high protein wheat foods for export; improved baking performance of blended spring and winter wheats.

Microbiology of cereal flours; milling artificially dried corn to improve yield, quality, and size of grits; milling and fractionation methods for production of wheat fractions of improved yield and quality for foods; conversion of starch to sugars and sirups; development of new low-cost corn foods for institutional use; development of grain sorghum endosperm products and their use in convenience foods; rennin from microbial sources.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

Cereal and Forage Crops (contd.)

Improved feeds--Improving the nutritive value of alfalfa, wheat, small grains, and mill fractions for ruminant, poultry, and swine feeds; dense, stable, concentrated low-fiber forage products for export; separate recovery of protein and other feed nutrients from forages.

Fusarium toxins and other mycotoxins as causes of toxicity in tall fescue; aflatoxin in grain.

New industrial uses--Starch graft copolymers as flocculating, viscosity-improving, and adhesive agents; cationic starches and flours for coating and sizing paper; development of starch-derived chemicals for plastics and coatings; reinforcement of rubber with starch by latex masterbatching; new classes of high-amylose corn starch for industrial use; development of dialdehyde starch-protein plywood glue; lower cost process for xanthan production; production of spores to control Japanese beetle infestations; discovery and evaluation of microbial polysaccolloids for industrial use; microbial production of L-asparaginase, a therapeutic factor active against leukemias; development of biodegradable surfactants and detergent builders from starch.

Cotton, Wool, and Other Fibers

Cotton chemical processing--Improved durable-press cotton fabrics; cotton products with improved soil resistance, launderability, and drying characteristics; improved mildew, rot, water, weather, and air pollution resistance in cotton products; development of low-cost flame-retardant cotton batting; insect resistant and easily reusable cotton cereal grain bags; flame-retardant cotton products with other desirable properties.

Cotton mechanical processing--Improved spinning efficiency and yarn quality; improved cotton prespinning processes; aerodynamic-electrostatic-ultrasonic spinning system; improved utilization of discount cotton.

Improved wool and mohair products--Improved wool and mohair fabrics requiring minimum upkeep; improved fabrics from wool and mohair blends.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

Fruits and Vegetables

Development of convenience-in-use fruit and vegetable products, and processing equipment for their economic manufacture, together with fundamental investigations of factors affecting color, texture, and flavor:

Citrus and subtropical fruits--Orange and grapefruit products with improved flavor and quality; improved Texas citrus products; freeze-dried citrus and subtropical fruit and vegetable product development; foam-mat-dried orange products; comminuted citrus products; sweetening agents from citrus flavonoids; improved stability and flavor of non-frozen subtropical fruit juice concentrates and purees.

Deciduous fruits and berries--Evaluation of processing characteristics of Pacific Northwest berries and other fruit; improved piece-form and powdered dehydrated fruit products; dried fruit and tree nut products for foreign markets; improved processes for wine production; control of pollution and conversion of waste products of fruit processing; reduced microbial contamination in processing of fruits; changes in pesticide residues during processing of fruits.

Improved piece-form dehydrated fruit products; reducing processing losses from mechanically harvested apples and cherries; evaluation of processing characteristics of new eastern pear varieties.

Vegetables--Development of controlled food fermentation processes; modified and enriched products from sweetpotato puree and flakes; dehydrated celery products with improved flavor; improved tomato and other vegetable products.

Frozen vegetables with improved texture; dehydrated vegetables of improved quality and stability for export markets; evaluation of processing characteristics of Pacific Northwest vegetables; control of consistency of tomato products; convenience foods from dry beans and peas; canned low-acid foods of improved quality and safety; control of pollution and conversion of waste products from the processing of potatoes and other vegetables; reduced microbial contamination in vegetable processing; changes in pesticide residues during vegetable processing.

Effect of source factors on the quality of processed potato products; application of "explosion-puffing" techniques to potatoes, carrots, celery, green peas and lima beans; recovery of useful materials from potato wastes.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

Oilseeds

Food Uses--Elimination of the physiological effects of cyclopropenes to safeguard foods containing cottonseed oil; development of processes for making new type food-grade esters from cottonseed oil fatty acids; preparation of confectionery fats and other edible, sharp-melting fats from cottonseed oil; edible high-protein cottonseed products; detection, estimation, prevention, and elimination of aflatoxins in cottonseed; elimination of salmonella in cottonseed meal products; detection, estimation, prevention, and elimination of aflatoxins in peanuts; improved low-fat peanut products; high-protein peanut products for export markets; roasted peanut products of improved flavor and stability.

Improved thermal and oxidative stability of safflower oils. Development of high-protein foods from full-fat soy flours for export markets; improved flavor stability of soybean oil by selective hydrogenation of linolenate esters with non-nickel catalysts; development of soybean protein isolates to replace imported casein; development of processes for the removal of objectionable flavors and other undesirable factors from soy flours; lower cost process for refining soybean oil with reduction of water pollution.

Feed Uses--Properties and utilization of amides from cottonseed oil; improved cottonseed meals for nonruminant feeding through the use of polar solvent systems; improved animal feedstuffs from safflower and other western oilseeds; production of safe-to-handle nutritious feedstuffs from castor bean meal; improving protein feed supplements from oilseeds containing erucic acid.

Industrial uses--Properties and utilization of amides from cottonseed oil; utilization of western seed oils in industrial products; linseed oil for curing and protecting concrete; improved durability of linseed oil emulsion paints; development of high-performance jet lubricants from linseed and soybean oils; development of nylon-type polyamides from vegetable oils; allyl resins from soybean, linseed, and high-erucic oils for coatings and plastics; special-purpose plasticizers from soybean, linseed, and high-erucic oils.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

New and Special Plants

Investigations to develop compositional data on plants from world-wide sources, to find alternate crops to fill needs not now met by domestic sources; and to develop new and more economic uses for special domestic plants:

Naval stores products--Condensation polymers from rosin derivatives; new or improved derivatives from rosin for use in adhesives and concrete.

Tobacco--Studies of physiologically-active compounds in tobacco leaf and smoke; determination of products formed on burning leaf tobacco; effect of added chemicals on smoke composition; development of rapid bioassay methods and measurement of tobacco smoke condensate by these methods.

New alternate crops--Search for new plant sources of industrial vegetable oils among 10,000 samples from world-wide collections; development of technology for production of marketable rotenoid products from the legume Tephrosia vogelii; development of paper-making pulp from kenaf by the sulfate process; tumor-inhibiting substances from plant materials.

Other crops--Development of methods for purifying sweet sorghum juices that will permit practical recovery of their sugar content.

Poultry, Dairy, and Other Animal Products

Development of better and more economical food products from poultry, eggs, milk, and meat, and development of new industrial outlets for fats, hides, and other animal byproducts:

Poultry and eggs--Low-cost, uniform aging of poultry for freezing; process modifications to improve and extend the variety of poultry products; elimination of processing damage to egg products; control of salmonella in poultry meat, liquid eggs, and dried eggs; processes to improve the aroma and flavor of cooked poultry.

Dairy products--Dry whole milk for beverage use; improving properties of sterile concentrated milk; stabilized milk fats as flavoring agents in food; low-fat cheese; cheese whey-plant product blends for food use; controlling microbial contamination of dairy products; control of allergens in milk.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

Poultry, Dairy, and Other Animal Products (contd.)

Meat products--Improving stability of meat and meat products; new meat products suitable for production in small rural industries; improving smoked meat products; new frozen meat products; controlling microbial contamination of meat and meat products.

Animal fats--Biodegradable detergents from animal fats; lubricant components from animal fats; plastics, resins and plasticizers from animal fats; color and odor stability of commercial fatty acids.

Hides and leather--Improved technology of leather manufacturing, including continuous processing; chemical modification of leather to improve its launderability, perspiration resistance, color-fastness, scuff-resistance, and self-polishing properties; microbiological studies of shearlings for use in hospitals and disinfecting procedures for them; determining nature of and controlling hide and skin defects; new food product uses for collagen.

VI FINANCIAL INFORMATION

The F. Y. 1969 and F. Y. 1970 domestic utilization research and development funds under "Salaries and Expenses, Agricultural Research Service," including allotments from the Special Fund for additional labor, are as follows:

	F. Y. 1969 (Obligations)	Proposed Distribution F. Y. 1970 (Estimated)
Cereal and forage crops.....	\$ 7,131,753	\$ 7,561,200
Cotton, wool, and other fibers..	6,534,217	7,106,000
Fruits and vegetables.....	5,296,165	5,766,300
Oilseeds.....	4,324,301	4,587,200
New and special plants.....	3,191,579	3,476,300
Poultry, dairy, and other animal products.....	<u>6,686,452</u>	<u>7,236,100</u>
Total, Utilization Research and Development.....	\$33,164,467	\$35,733,100 <u>a/</u>

a/ Includes proposed supplemental appropriation of \$2,081,000 to meet 1970 pay costs authorized by Executive Order 11474 issued pursuant to the Postal Revenue and Federal Salary Act of 1967 (P. L. 90-206) and wage board costs. For the most part the increased pay rates were effective in July 1969.

In addition to the 1969 total shown above, \$59,995 was obligated under nonrecurring allocation from the Contingency Research Fund for development of technology to remove chlorogenic acid from sunflower meal, and \$52,625 for development of standardized methods for detection and enumeration of microorganisms for foods.

Supplemental Information

(A) In addition to the domestic program, the equivalent of approximately \$694,600 in foreign currencies was obligated in F.Y. 1969 for utilization research projects (largely extending over a five-year period) conducted under agreements with foreign institutions. This work is financed by funds generated under the P. L. 480 program.

(B) F.Y. 1970 changes over F.Y. 1969 funds available of \$33,263,400:

1. The F.Y. 1970 Appropriation Act also provides for the following increases:

Cane sugar refining research, New Orleans, Louisiana	50,000
Upgrading quality of processed peaches, Athens, Georgia.....	<u>92,500</u>
Subtotal.....	142,500
2. Transfer of function on "textiles and clothing research" from the financial project "Nutrition and Consumer Use Research." Revised functional organization chart and letter of approval dated February 6, 1969 from the Director of Personnel	265,200
3. Redistribution of Special Fund	-1,000
4. 1970 proposed supplemental pay cost	2,081,000
5. Transfer to the Office of the Inspector General for compliance reviews (audits) of ARS domestic grants, contracts, and co- operative agreements with colleges, universities, and other organizations	<u>-18,000</u>
Total	2,469,700

VII SELECTED RESEARCH ACCOMPLISHMENTS

Examples of the current program of utilization research were given in Section V of this report. In the present section are presented 19 selected examples of recent accomplishment under this program. For the most part, these examples concern research that has proceeded through the applied and developmental stages to the point of commercial acceptance of the processes or products involved. The accomplishments are illustrated on the facing pages.

Instant CSM Food Blend for Domestic and Foreign Food Aid Program

A nutritious food blend for mass feeding, which is especially suitable as a high-protein supplement for weanling infants and small children, has been developed by USDA food technologists. Called "Instant CSM" (corn-soy-milk), it is similar in composition to the regular CSM, of which over a billion pounds have been distributed abroad by **voluntary** relief agencies. However, the improved product is completely pre-cooked and is made ready for instant consumption by merely mixing with water and allowing to stand for a few minutes; also, it contains sugar to increase its acceptance by children. Elimination of cooking is important because of fuel shortages and costs in many areas.

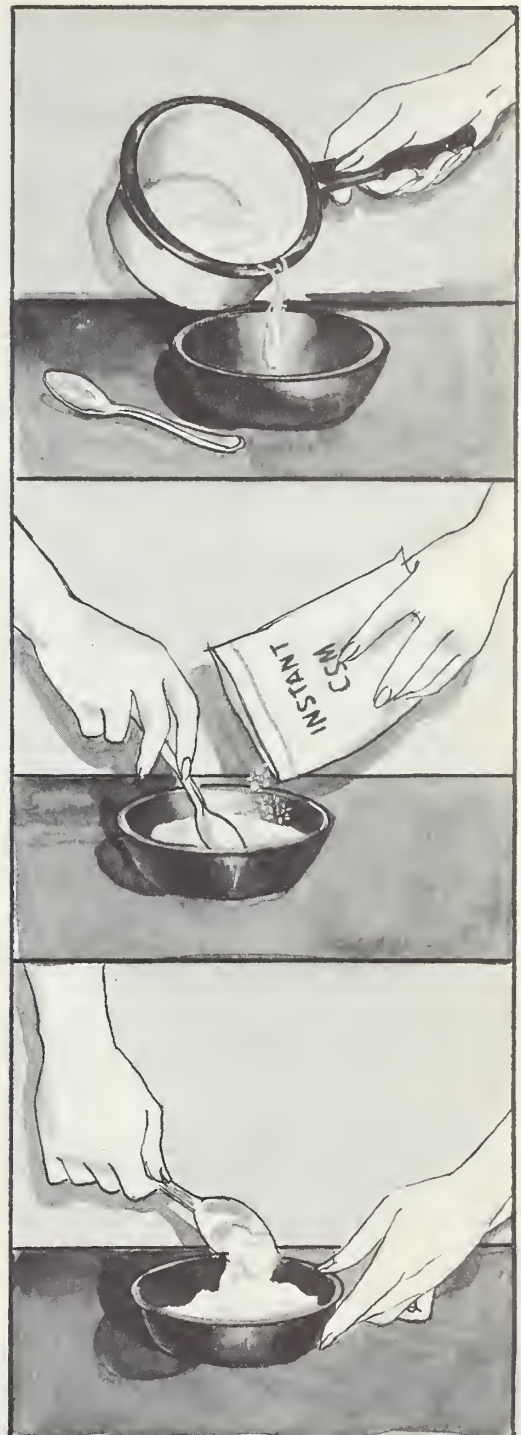
The corn and soy components are individually cooked, then dry-blended with nonfat dry milk, vitamins, sugar, salt, and minerals. The resultant blend serves as a palatable, acceptable, nutritious food that offers great potential in world feeding.

Multi-ton quantities of this improved product have been prepared for and distributed by UNICEF to East and West Africa and to India, where acceptance has been quite favorable. The cost of this material is only slightly higher than regular CSM; the increase results largely from the higher cost of the added sugar. The product could be distributed in addition to regular CSM in the foreign donations program, and may also find a place in our domestic market.

**NO COOKING...ADD
TO WATER AND STIR**

"INSTANT CSM" (CORN-SOY-MILK)

**Nutritious
Food Blend
Developed by USDA
as a High Protein
Supplement
for Infants
and Small
Children**



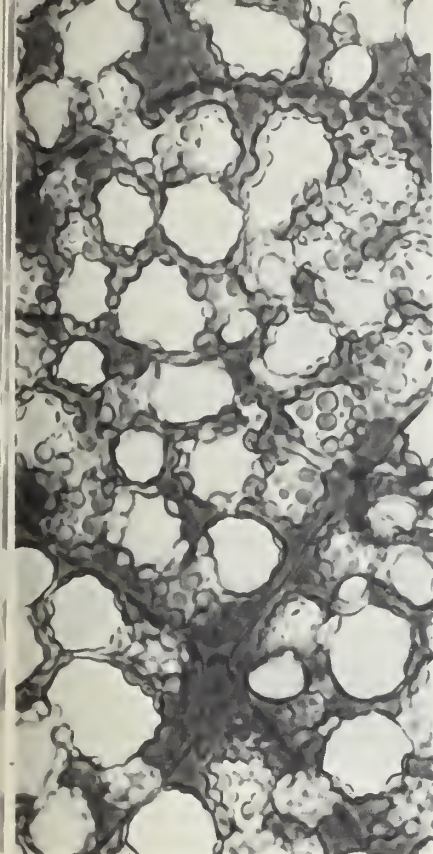
for Distribution by
**FOREIGN AID
PROGRAMS**

**Potential use in
Domestic Programs**

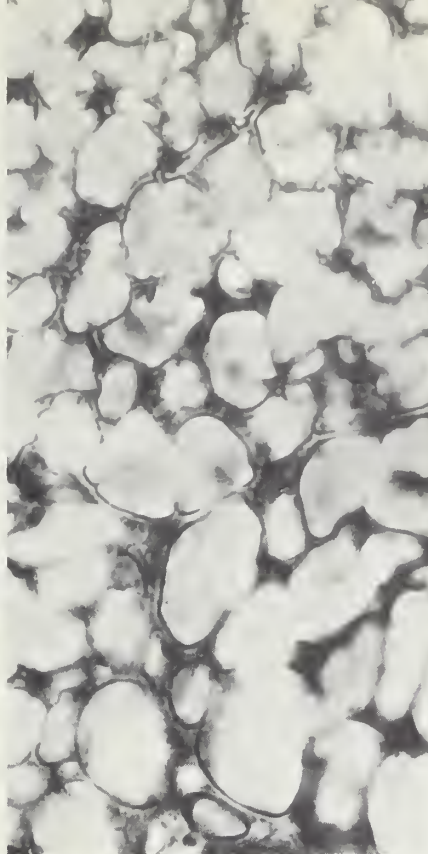
Microscopic Identification of High-lysine Corn

Research by Department scientists on the location of protein in corn kernel cells has revealed a novel way to quickly identify strains of corn that contain protein rich in the nutritionally-vital amino acid, lysine. Studies have shown that the microscopic structure of high-lysine corn kernels differs in a characteristic way from that of kernels of ordinary dent corn. By a simple microscopic examination of kernels of new strains, investigators can now quickly identify those that are high in lysine, whereas formerly it was necessary to perform time-consuming chemical analyses.

The nutritional quality of high-lysine corn protein is much higher than that of ordinary corn protein. In areas of the world where corn is the basic food, malnutrition would be alleviated or eliminated if high-lysine corn were consumed. Domestically, there are segments of our population that would benefit nutritionally if corn foods were based on high-lysine corn. Livestock producers also would benefit from use of high-lysine corn in their operations. To realize the great potential benefits of high-lysine corn, strains are needed with better agronomic properties for adaptation to specific growing areas, and that can be economically processed by the usual dry milling methods. The new method for identifying high-lysine corn kernels will shorten the time required for breeders and processors to find such strains and develop them commercially.



NORMAL



HIGH LYSINE

**FAST
MICROSCOPIC
TEST
IDENTIFIES
CORN...
WITH
HIGHLY
NUTRITIOUS
PROTEIN**

**Simple Examination Locates Corn
Strains with More Lysine...
Replacing Lengthy Chemical Analysis**

**BENEFIT IN BREEDING AND DEVELOPMENT
OF HIGH LYSINE CORN STRAINS
TO IMPROVE WORLD NUTRITION**

High-amylose Starch Use Advanced by New Analytical Technology

Department scientists have developed new and improved analytical and control technology for high-amylose corn that is aiding in the accelerated production and utilization of this increasingly important U. S. crop. Increased efficiency and speed of analysis have provided information and procedures for guiding the selection of varieties for planting and evaluation of the materials produced.

In 1968, over a million bushels of high-amylose corn were grown under contract (for a premium) on more than 10,000 acres of land. The resultant corn was milled by five industrial companies into the desired finished products. Present production expansion is limited to the rate at which the high-amylose seed can be developed and made available.

High-amylose starch is finding new and growing markets in such uses as glass-fiber size, paper coatings and additives, water-soluble and edible films, and candies. The farmer, industry, and consumer are all benefiting from this development.



NEW
TECHNOLOGY
ADVANCES
HIGH-AMYLOSE CORN USE

**COMMERCIAL DEVELOPMENT ACCELERATED
BY IMPROVED METHOD OF STARCH ANALYSIS**

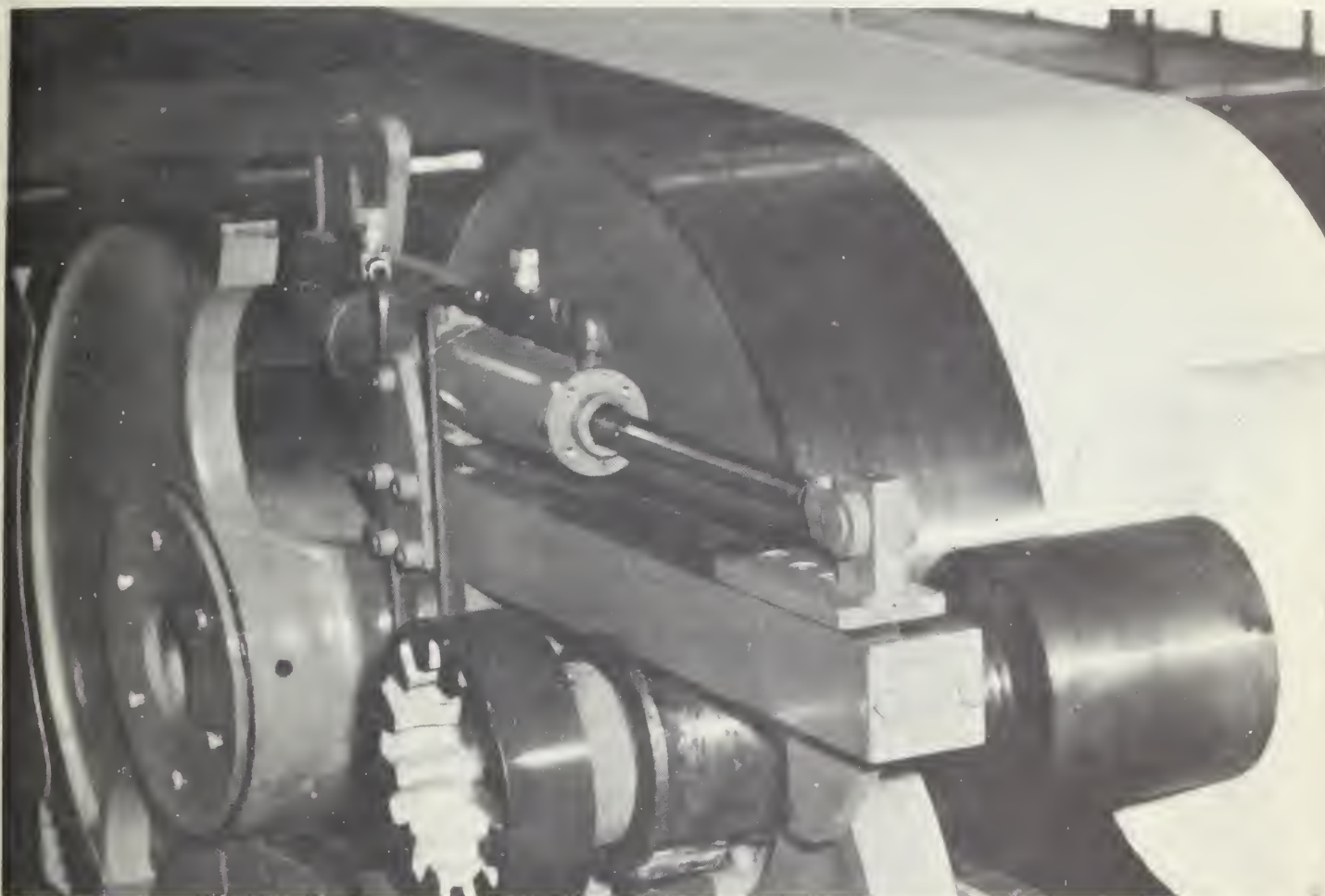
**CONSUMERS BENEFIT BY LOWER COST
AND IMPROVED PRODUCTS**

Cationic Flours Developed for Papermaking Industry

In studies to increase the industrial utilization of cereal flours, Department scientists have developed cationic (positively charged) corn, wheat, and sorghum flours for use as internal additives in papermaking. In an 8-hour trial run conducted in November 1969 at a commercial paper mill, the new cationic corn flour was applied in the production of a pigmented bag paper. The results were most successful. Paper containing the flour product is as good as paper containing conventional additives, and is cheaper. In addition, the cationic corn flour enhances the pigment color in the finished sheet to such an extent that the amount of pigment could be decreased by 25 percent; this represents a potential saving of \$6 per ton on pigment alone. The mill management was enthusiastic. Since a dry process is used, recovery is quantitative, and no waste disposal problems are encountered, like those associated with the production of conventional cationic starches, which are made by wet methods.

Other dry millers also are collaborating with USDA in the evaluation and industrial development of cationic flours. One miller has estimated that the potential market for cationic starches and flours in papermaking is about 200 million pounds per year. A large part of this volume would be new markets made possible by the low-cost and high-performance characteristics of cationic flours.

**...Industrial Value of New Flour Products
Proved in Commercial Mill Runs...**



**Cationic Corn Flour
Produces an Economical
Paper Stock with ...
Improved Strength...
Smoothness...
and Printability**

Starch-based Reinforcing Agents for Rubber

Department scientists have developed three starch-based reinforcing agents for rubber (zinc starch xanthate, starch xanthide, and starch-resorcinol-formaldehyde resin). Laboratory-scale evaluations show that these starch products are comparable to medium-grade carbon black and superior to common clay in improving tensile strength and most other physical properties of natural and synthetic rubbers. All three of the starch products are incorporated into rubber by minor variations of a simple basic process that is compatible with current practices in the industry. Masterbatches of selected starch-reinforced rubbers were prepared and evaluated for a number of applications under a USDA contract with a research group expert in rubber chemistry. On the basis of cost and overall properties, the starch-reinforced rubbers are competitive with conventional rubbers for a number of applications, and superior in others. The best opportunities for use of starch-reinforced rubbers are in the production of general-purpose molding compounds, shoe soling, and oil-resistant rubber products. Starch-reinforced rubbers are naturally semitransparent, and hence can be dyed or pigmented to give brightly-colored products. Current annual domestic consumption of reinforcing agents in rubber is about 5 billion pounds; thus, the potential market for starch-based reinforcing agents is large, even on a partial replacement basis. Much industrial interest has been evidenced in the development. One public-service patent on the process has been granted, and others are being pursued.

STARCH REINFORCED RUBBER

**USDA Develops New Use
for Cereal Starch**

LABORATORY TESTING OF THREE AGENTS

**STARCH
XANTHIDE**

**ZINC STARCH
XANTHATE**

**STARCH-
RESORCINOL-
FORMALDEHYDE
RESIN**

SHOWS...

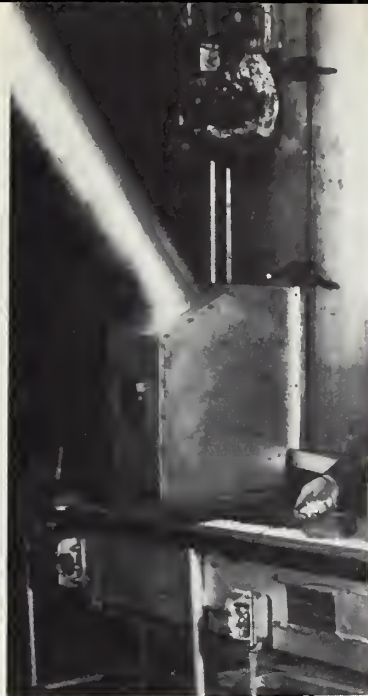
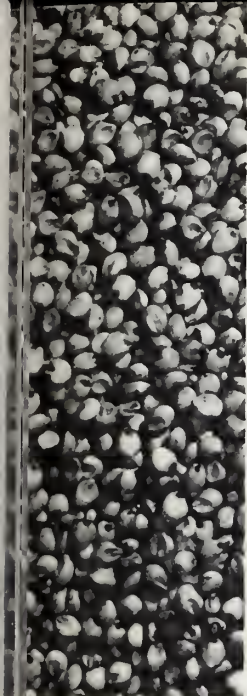
- **IMPROVED TENSILE STRENGTH**
- **COMPETITIVE COST**
- **SEMI-TRANSPARENT - COLOR
CAN BE ADDED**



**POTENTIAL FOR
CEREAL STARCH IN THE 5 BILLION lb. MARKET IN RUBBER**

Popped Grains for Feed Use

All grains fed in commercial beef feedlots are processed to improve their digestibility. Department scientists have studied hot-air expanding (popping) of grains as an alternative to the more conventional steaming and flaking or pressure-cooking and flaking operations. Milo pops like corn; other grains puff to varying extents. An experimental 1-ton per hour popper was used to prepare grain for a sheep feeding test. Animals appeared to prefer the new forms of grain. The test results encouraged a Texas company to build its own grain popper. The commercial machine, processing 4 tons of grain per hour, sells for \$22,000; so far, orders for 50 machines have been received. Savings of \$1 per ton of grain in processing costs over other methods are claimed. With 30 million cattle handled annually in U.S. feedlots, each consuming an average of 15 pounds of grain daily for 150 days, almost 34 million tons of grain must be processed. If savings of \$1 per ton could be realized on even a portion of this grain, it would amount to many million dollars per year.



GRAIN POPPING LOWERS FEED COSTS

**New Process Leads to Commercial
Production of a 4 Ton Per Hour
GRAIN POPPER**

**DIGESTIBLE, ECONOMICAL ANIMAL FEED
PRODUCED FOR FEED LOT USE**

**OVER ONE MILLION DOLLARS
ESTIMATED SAVINGS A YEAR**

Wet Processing of Alfalfa

A practical process for recovery of leaf protein has moved a step closer to realization. A California alfalfa dehydrating company, working with Department scientists, has started a commercial scale operation to reduce the cost of production of dehydrated alfalfa and to recover high-protein concentrate as a co-product. The design of the firm's plant is based on a USDA-developed pilot plant for separating fresh alfalfa into two primary products--a good quality dehydrated alfalfa, and a high-protein concentrate that is also rich in carotene and xanthophyll.

The extraction process under study will provide the basis for direct utilization of vast amounts of leaf protein as human food, and still permit the preparation of valuable animal feeds, such as the carotene-xanthophyll fraction without the protein, for poultry feeding. Previous efforts to recover food protein directly from leaves have emphasized the yield of edible protein, and have viewed feed fractions as byproducts. The recovery of maximum feed values is expected to make the new process economically sound, with a bonus of producing a 50 percent protein product representing about 15 percent of the original alfalfa protein.

NEW PRODUCTS FROM ALFALFA

Commercial Trials Started on a Wet Process that Recovers Leaf Protein by Separation of...

FIBER & LIQUID

**GOOD QUALITY
DEHYDRATED ALFALFA**



**CATTLE FEED...
DRY PELLETS
OR MEAL**

**HIGH PROTEIN
CONCENTRATE**

**DRY POWDER-
FIBER FREE-
POULTRY FEED
OR**

**LIQUID SUPPLEMENT
CONTAINING XANTHOPHYLL
PIGMENT FOR GOOD COLOR**



- **Method Reduces Manufacturing Cost and Increases Output**
- **Potential Source for Human Protein Food**

New Flame-retardant Finish for Cotton

Each year in the United States alone, from 3,000 to 5,000 persons die and hundreds of thousands suffer non-fatal burns from ignited clothing, bedding, and upholstered furniture. An efficient new flame-retardant finish for cotton recently developed by Department scientists--the THPOH finish--can help reduce these deaths and injuries. This new finish was derived from THPC, developed earlier by the Department, which has excellent flame-retardant properties but is not satisfactory for lightweight fabrics. THPOH can be used for all weights of fabrics including lightweight apparel, such as children's nightwear, since the fabric retains essentially all of its original strength and softness. Another advantage is that the treated fabric exhibits less yellowing when exposed to chlorine bleach. Two major chemical companies are producing THPOH for commercial use.

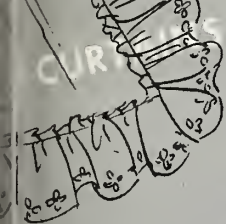


FLAME-RETARDANT FINISH FOR ALL COTTON FABRICS

New Treatment Includes
Lightweight Fabrics to
Extend Consumer Protection
to All Cotton Textiles

MAINTAINS: Strength
Softness
Durability

NOW COMMERCIALY AVAILABLE



Mechanical Harvesting of Cherries

Mechanical harvesting of red tart cherries is now a definite commercial success, with 85 percent of the 1969 crop handled by this method. Jointly developed by the Department's utilization research and engineering groups in collaboration with Michigan State University, the shake-and-catch system has produced savings of nearly \$19 million in harvesting costs over a seven-year period, and has permitted the salvaging over a two-year period of \$13 million worth of fruit too sparse to permit traditional handpicking. Close cooperation among growers, processors, and researchers has overcome substantial problems in quality losses and processing slow-downs. Acceptance of the new methods has been greatly accelerated by critical farm labor shortages. Lessons learned during the development of systems for mechanically harvesting and processing tart cherries can be applied to harvesting the more difficult fruit crops.

"SHAKE-AND-CATCH"

TART CHERRY HARVESTING



85% of 1969 CROP HARVESTED MECHANICALLY

Reduces HARVEST COST \$19 million in 7 years

Increases FRUIT RECOVERY \$13 million in 2 years

Citrus-based Low-calorie Sweeteners

Department scientists, studying ways to reduce bitterness of citrus products, discovered that they could convert two bitter components (naringin from grapefruit and neohesperidin from bitter oranges) into extremely sweet compounds. The naringin derivative is about a third as sweet as the well-known synthetic sweetener saccharin, or 100 times sweeter than ordinary table sugar; the neohesperidin derivative is about 7 times sweeter than saccharin. A third new sweetener has been prepared from the tasteless substance hesperidin, which is the major flavonoid constituent of lemons and sweet oranges. The sweetness of all these citrus-based products is pleasant and long-lasting. A further advantage is that none of them has shown evidence of toxicity in preliminary studies on animals. The commercial availability of naringin and hesperidin as byproducts of the grapefruit and orange processing industries has aroused the interest of numerous chemical, food, and drug companies in manufacturing a non-caloric sweetener from them. The Department has produced substantial quantities of the sweeteners for use in long-term feeding tests that are being initiated to demonstrate fully the safety of the products.

LOW CALORIC SWEETENERS FROM CITRUS

FLAVANONE DERIVATIVES FROM:

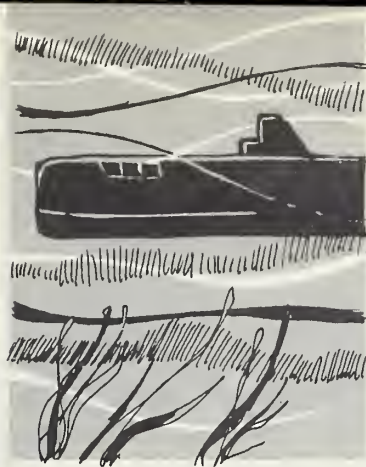
		
100× SWEETER THAN SUGAR	2000× SWEETER THAN SUGAR	100× SWEETER THAN SUGAR

PLEASANT LONG LASTING SWEETNESS

- ▶ Preliminary Tests Show "NO TOXICITY" Evident
- ▶ Industry Interest for Manufacture of a Non-Caloric Sweetner

Orange Juice Tablets--a New Citrus Product

A small, flavorful orange disc that can be eaten like candy may offer a new outlet to citrus processors and a new product to consumers. Developed by Department scientists in cooperation with the Florida Citrus Commission, the tablets are prepared from concentrated orange juice that is dehydrated and pressed into any desired shape or size. Since they consist almost entirely of natural juice solids flavored with enrobed orange oil, they have all the nutritive advantages of orange juice, including caloric content, vitamin C, other vitamins, and minerals. Lightweight and compact, they do not require either refrigeration or reconstitution. Consequently, they should find markets as both a nutritious convenience food and a confection. In addition to their appeal to the usual consumers, they are ideal for specialty markets; for example, they will be taken on a trial run of a new submarine and may also be used in future space flights. Because of these diverse potential uses, not only citrus processors and confectioners, but also pharmaceutical companies, have expressed interest in the tablets, which are expected to be commercialized soon.



ORANGE JUICE TABLETS

... "TO GO"

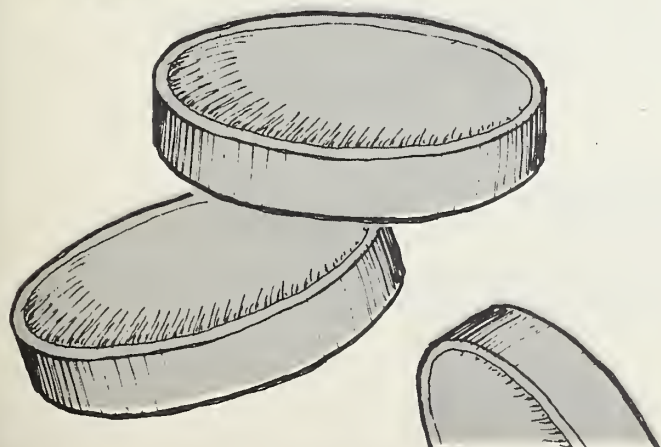
✓ **Anyplace... Anytime**

✓ **Require No Refrigeration
or Reconstitution**

✓ **Contain Nutritive Advantages
of Natural Orange Juice...**

Calories Vitamins and Minerals

**CONSUMER APPEAL
IN CONFECTIONS PLUS
NUTRITIONAL POTENTIAL**



Improved Frozen Orange Juice Concentrate

The Department has developed and demonstrated a new system of aroma recovery for frozen citrus concentrates. This method, known as "WURVAC," has formed the basis for variations now used by several of the largest citrus processors. The earlier "cutback" process, long in use, requires overconcentration of the juice, followed by addition of fresh juice to result in a sale-strength of 42 percent solids. WURVAC, on the other hand, collects very strong aroma solution from the vacuum evaporator in the cooled sealant liquid of the vacuum pump. This can be returned to the concentrate without appreciable dilution and in quantity sufficient to give an improved product. The WURVAC aroma collected is complete, including the volatile flavors as well as the peel oil.

This development also may result in more highly concentrated citrus products, both liquid and powder, which have natural aromas. It is based on years of basic research on the composition of citrus flavors.

**FROZEN
CITRUS
CONCENTRATE WITH
ADDED
AROMA**

**Improved
"WURVAC"
Method**

**Collects Aroma in Vacuum Pump
and Returns it to Concentrate During
Processing...**

**Results...A HIGHLY CONCENTRATED
IMPROVED PRODUCT**

Processed Hawaiian Fruit for World Markets

Department scientists, in cooperation with the Hawaii Agricultural Experiment Station, have made considerable progress during the past few years in developing high-quality processed products from Hawaiian-grown tropical and subtropical fruits, in order to diversify an agriculture that has been primarily devoted to sugarcane and pineapple. Equipment for producing papaya puree has been developed which slices the fruit, removes the peel, and separates the seeds. The puree, which has a superior flavor because it contains no bitter taste from the peel, is used for jam and jelly products.

Techniques have also been developed for production and storage stabilization of guava puree, which is remanufactured into a variety of products such as beverages, dairy products, jams, and jellies.

Two new banana products resulting from Department research are being produced commercially, thus demonstrating the technical feasibility of the processes. One of these, a puree that is stabilized for several weeks' storage at 45°F., is useful in bakery and dairy products. The second product is a specially vacuum-dried banana that has been used as a chocolate-covered confection.

These new stable forms of tropical fruit should open new markets all over the world provide a broader base for Hawaiian agriculture.



PROCESSED HAWAIIAN FRUIT

FOR MAINLAND MARKETS



PUREE has been
developed for
high quality
processed
products from
PAPAYA
GUAVA
and **BANANA**

NEW COMMERCIAL OUTLET FOR
HAWAIIAN AGRICULTURE

JAMS • **JELLIES** • **BEVERAGES**
CONFECTIONS • **DAIRY and BAKERY PRODUCTS**

Vitamin Fortification of Potato Flakes

Several surveys in 1965-66 showed that the nutrients most often lacking, even in families with good diets, were calcium, vitamin A, and vitamin C. In research on improvements in dehydrated potato flakes, USDA engineers had previously shown that fortification of potato flakes with vitamin A, vitamin C, and niacin was practical, and that vitamin retention on storage was excellent. This research is now paying off in improved nutrition for American families, especially those in need, since vitamins A and C are now available in a low-cost food normally eaten in large quantity. In 1968, USDA's Consumer and Marketing Service purchased over 14 million pounds of potato flakes fortified with vitamins A and C, for distribution in its needy family program. Purchases in 1969 amounted to about 17 million pounds.

FORTIFIED POTATO FLAKES

**Low-Cost Food Now HIGH IN VITAMINS
...by Addition of A and C ... a Nutrition
Improvement for All Diets**



◀ **FAMILY
CONVENIENCE
FOOD**

◀ **GOOD FOR LARGE QUANTITIES**

▶ **OVER 16 MILLION POUNDS
DISTRIBUTED IN 1969
IN USDA NEEDY FAMILY PROGRAM**

"Dry" Caustic Peeling of Potatoes

A new peeling process will virtually eliminate the water pollution caused by the commercial peeling of potatoes which is now equivalent to the domestic sewage from seven million people. This "dry" caustic peeling process, developed by Department scientists, has been tested with commercial equipment at semi-plant scale.

With this technique, as much as 95 percent of the peel waste can be removed from the potato without the use of water, thus avoiding 75 percent of the organic water pollution arising from present peeling methods, as well as keeping nearly all of the lye out of the plant effluent. An added benefit is a marked reduction of peeling losses, giving increased product. The dry peeling waste is expected to find outlets as animal feed.

One major potato processor has received a grant from the Federal Water Pollution Control Administration to install a 20,000-pound-per-hour or larger plant to demonstrate the process on a full-size commercial processing line. Another firm has purchased the semi-plant-scale line for its own use. This accomplishment will avoid the need for investment of about \$11 million in secondary waste treatment facilities and more than \$4 million annually in operating costs. This can benefit all users of waterways (municipalities, sportsmen, farmers, industries, etc.) and can reduce prices that the consumer must pay for processed potato products.

Water Pollution Problem

from **Industrial Potato Peeling**
GREATLY REDUCED by.....



- **Peel Removed by Waterless Method**
- **Reduces Potato Losses**
- **Peel Waste a Potential Animal Feed**
- **Reduces Consumer's Price for Processed Potato Products**
- **Commercial Use Started**

New Military Market for Soybean Salad Oil

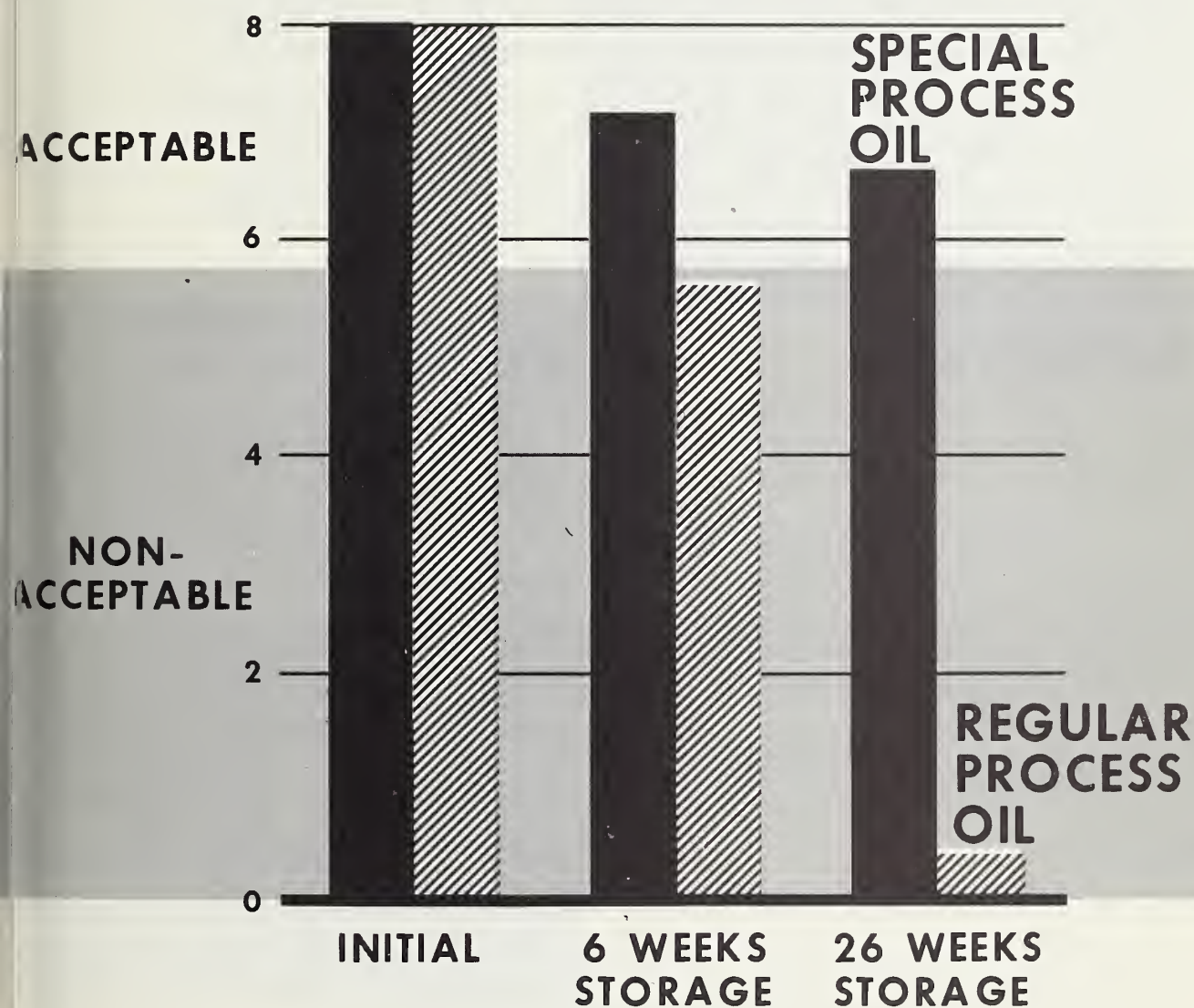
Based on results of stability tests conducted by USDA scientists, the Army Natick Laboratories have been drafting a proposed new section for their salad oil specification to include a soybean oil that is packaged under nitrogen and may contain up to 3 percent linolenic acid (the unsaturated fatty acid that is associated with rancidity in oils). Since the Military is reported to use from 35 to 45 million pounds of salad oil each year, the new specification points the way to a significantly increased market for soybean salad oil, and will give the Military greater freedom in procurement.

Most salad oil for the Armed Forces has been purchased under specifications that did not permit over 0.5 percent linolenic acid in the oil. This requirement was established because the Military needs salad oils that are stable in their original packages for 6 months at 100°F. Early tests found linolenic-containing oils to have insufficient stability. For example, as formerly processed and packaged, oils like soybean salad oil with 6 to 9 percent linolenic lost their initially acceptable flavor in 3 to 6 weeks at 100°F.

By 1967, some domestic suppliers of soybean salad oil had improved the stability of their product by procedures which followed USDA recommendations. Consequently, USDA scientists undertook new studies on the stability of these improved commercial soybean salad oils in cooperation with the Natick Laboratories. These studies demonstrated that some of these commercially available, specially processed soybean salad oils maintained oxidative stability and food flavor quality on prolonged storage for 9 to 12 months at 100°F. The work also enabled USDA to provide the technical details of composition, processing, and packaging required for preparation of the revised military specification.

SPECIAL PROCESS SOYBEAN OIL PASSES USDA STABILITY TESTS

FLAVOR



**35-45 MILLION POUNDS A YEAR
MILITARY MARKET OPEN TO
NEW METHOD SALAD OIL**

Ultraviolet Preservation of Maple Sap

Ultraviolet pasteurization of maple sap, a recent USDA development, is being used by sap processing plants as a practical, simple means of preserving quality during short-term storage of the sap.

Maple sap flows are erratic and can vary greatly in volume over a several-day period. Previously, when the volume of incoming sap exceeded the capacity of a processing plant, the choices were to make low-grade or sometimes unacceptable sirup from the stored sap, or to dispose of "excess" sap. Chemical preservatives cannot be used to control spoilage because residues may appear in the sirup at up to 40 times the concentration used in the sap.

Recent USDA-sponsored contract research by a New York State maple sirup producer has shown that with ultraviolet pasteurization of the incoming sap, combined with mixing and further irradiation during storage, sap can be held up to six days without impairment of the quality of sirup produced. Other processing plants were planning to use the development during the 1970 season.

ULTRAVIOLET TREATMENT SAVES STORED MAPLE SAP

BOOSTS PLANT
CAPACITY BY
INCREASING
STORAGE LIFE
FOR LATER
PROCESSING



EXCESS SAP STORED...
6 DAYS ... "UV" TREATED
2 DAYS... UNTREATED
MAKES QUALITY SIRUP

PROCESSING PLANTS
NOW USING
NEW METHOD

New Rosin Derivatives for Use in Adhesives

Department scientists have recently produced several new rosin derivatives with good industrial potential in the adhesives field. Particularly promising are polyester products made from rosin modified with acrylic acid, since they are useful in at least three major areas of adhesives--rubber tackifiers, pressure-sensitive adhesives, and hot-melt adhesives. A resin manufacturer has already produced one of these polyesters on a pilot-plant scale for evaluation by industry. A potential user of this new product anticipates a starting market of over three million pounds annually. The excellent qualities of the various rosin derivatives--good adhesion, versatility, and attractive cost--should make them strong competitors in the large adhesives market, which currently totals about a billion pounds per year.

NEW MATERIALS for ADHESIVES



**Rosin Derivatives
with Excellent
Industrial Potential
for...**

- RUBBER TACKIFIERS
- PRESSURE-SENSITIVE ADHESIVES
- HOT-MELT ADHESIVES

NOW UNDER INDUSTRIAL EVALUATION

New Anti-leukemia Compound

A new compound that slows the progress of experimental leukemia in laboratory mice has been isolated by USDA scientists from a yew-like evergreen shrub (plum yew). The substance is effective at very low dosages, considerably below the level at which it is toxic to the animals. Under preferred conditions of administering the drug, treated leukemic mice lived more than twice as long as untreated ones. Although the mice were not cured, their lengthened survival in the test is useful in predicting beneficial effects in treating leukemia, and possibly also some solid tumors, in other species of animals and man. The results are sufficiently encouraging to warrant preclinical pharmacological investigations in additional animals such as dogs and primates. The USDA chemists cooperated in this research with scientists of HEW's Cancer Chemotherapy National Service Center, who directed the animal tests and evaluations.

This anti-leukemia factor was discovered as a result of an extensive chemical survey of the plant kingdom to find useful new industrial, food, feed, and pharmaceutical substances in plants that can be grown as new crops in the United States. Altogether, more than 10,000 plant samples have been studied; about 200 of these have been tested for the presence of anti-tumor substances.



PLUM YEW

SEARCH FOR ANTI-LEUKEMIA FACTOR FROM NEW CROPS

**Results from Laboratory Testing
a Compound from Oriental Shrub
Show Anti-Tumor Activity**

**■ STUDIES OF OVER 10,000 FOREIGN PLANT
SAMPLES...CONDUCTED BY USDA...TO FIND
NEW CROPS BENEFICIAL TO UNITED STATES**



